

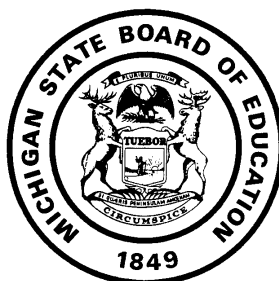


**Michigan Educational Assessment Program**

# **Size and Distance Investigation**

## ***Teacher Guide***

**Grade 5**



**Winter 2000**



# Size and Distance Investigation

## Grade 5

### Teacher Instructions

The size and distance investigation presents how we perceive the size of an object as influenced by the distance from which we observe the object. Students should be familiar with this phenomenon by considering the different-size images they see of large objects across various distances. For example, an airplane or car appears large when close to the observer, yet appears small when high in the sky or way down the road from the observer. Students, however, may not have applied this concept as they view stars and planets in the night sky because these objects always remain distant to the observer.

Students will experiment and present their findings in writing and in tables as they consider this question: **Does the distance of an object from the observer affect how the observer sees the size of the object?**

Each teacher will be provided with a **Teacher Guide**, sufficient copies of the **Investigation Journal** for each student, and materials to conduct the investigation.

#### Procedure:

##### Step 1

Review this document to help you prepare for classroom discussion.

##### Step 2

Collect the necessary materials and display them where students will have easy access to them. You should allocate the materials as a kit for each group to leave more class time for the actual investigation.

#### **Materials provided by MEAP** (for each group of 4 students)

- 1 sheet of white paper with 2 cm diameter black circle, labeled “circle 1.”
- 1 sheet of white paper with 2 cm diameter black circle, labeled “circle 2.”
- 1 sheet of white paper with 3 cm diameter black circle, labeled “circle 3.”
- metric ruler
- Investigation Journal (for each student)

#### **Materials provided by the school**

- masking tape

**Step 3**

Mark the distance layouts (see page 5) on the floor for each student group (using masking tape) before student groups begin their investigations. Mark:

- the observer's line
- a line 2 meters from the observer's line
- a line 6 meters from the observer's line

Each student group will need at least a 15-meter path for its work area. Use space available in large hallways, the gym, the cafeteria, the playground, etc.

**Step 4**

Have the students work in groups of four. Each student in a group will be an observer in the experiment. Assign who will be observer 1, 2, 3 and 4. The observer's findings will be recorded on the line for that observer in the data collection tables. While one student observes, the other students in the group will rotate through tasks of holding the circle cards at distances along the distance layout and measuring distances.

**Step 5**

Pass out one Investigation Journal to each student. Make certain that each student writes his/her name on the cover. Impress upon the students the importance of having a complete journal to use as a reference when they take the MEAP science test.

**Step 6**

Discuss with students the *Setting (Real World Context)* of the investigation. Present the question being investigated. Say: The purpose of this investigation is to answer the question, **Does the distance of an object from the observer affect how the observer sees the size of the object?**

Write the question on the board or display it as a poster. Have each student copy the question in the *Our Question* section (page 3) of the Investigation Journal.

**Step 7**

Lead a class discussion of the question and present some real-world examples familiar to the students. When it is apparent that all students understand the concept, direct students to complete the *What I Already Know* section on page 3 of their journals.

**Step 8**

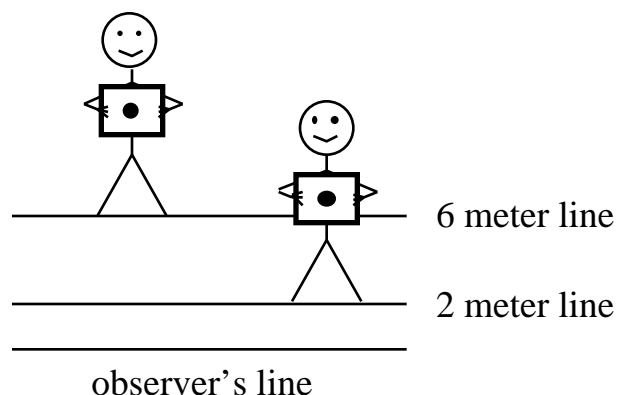
Have the students complete the *What I Think Will Happen—My Hypothesis* section in their journals.

**Step 9**

Demonstrate the procedure to be followed in Part 1 and Part 2 of the investigation.

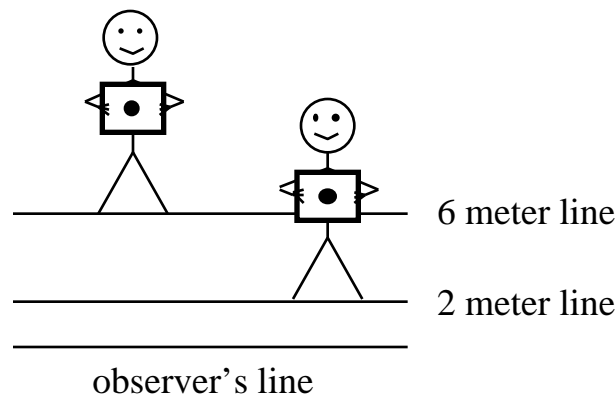
**Part 1**

1. Select an observer and have that student stand on the observer's line.
2. Have one member of the group hold circle 1 (a 2 cm circle) on the 2 meter line of the distance layout.
3. Have another member of the group hold circle 2 (a 2 cm circle) on the 6 meter line of the distance layout. The observer now compares how the sizes of circle 1 and circle 2 look and reports orally to the group. Record what the observer said for circle 1 and circle 2 on the line for that observer in Table 1.
4. Repeat steps 1, 2 and 3 until all students in the group have had a chance to be the observer for Part 1.



**Part 2**

5. Select a student as an observer and have this student stand on the observer's line. Have one student in the group hold circle 1 while standing at the 2 meter line. Have another member of the group hold circle 3 (a 3 cm circle) while standing at the 6 meter line. The observer compares the sizes of circle 1 and 3 and reports orally to the group. Record this information in Table 2 on the line corresponding to this observer's number.
6. Have the student holding circle 3 move forward or backward until circle 1 and circle 3 appear to be the same size to the observer. Record in Table 2 the distance that the person holding circle 3 is from the observer's line when the observer states that circle 1 and circle 3 appear to be the same size.
7. Repeat steps 5 and 6 until all students in the group have had a chance to be the observer for Part 2.

**Step 10**

After entering their own observations, make sure each student records the results of the other students' observers in their group in the tables.

**Step 11**

Use the information from the investigation to complete the *Summary of My Results*, *My Answer to the Question*, and *Some Possible for Errors* sections.

**Step 12**

When all the groups are finished, conduct a post lab discussion by engaging all the students in a discussion for the findings and conclusions. Pay special attention to the *Some Possible Errors* section, especially if group conclusions do not agree. It might be necessary to repeat the experiment so that all journals have the same information.

**Step 13**

Direct the students to hand in their completed journals to you. The journals should be stored in a safe place and returned to the students just before they take the MEAP science test.

## Sample Student Responses To Size and Distance Investigation

### Grade 5

This teacher's information is supplied by MEAP as a reference guide for the Size and Distance Investigation Journal. The procedure in this document is identical to the procedure found in the Size and Distance Investigation Journal. The sample answers provided may not necessarily reflect your students' work.

MEGOSE objective(s): C-2 C-4 C-5 R-1 ES-1<sup>1</sup>

#### Question:

Does the distance of an object from the observer affect how the observer sees the size of the object?

#### What I Already Know:

It is difficult to judge the size of objects in space by observation **alone**. Objects that appear larger (such as the moon) may in fact be smaller than other objects (such as stars) which **look** smaller viewed by an observer on Earth.

I know when you look at an airplane in the sky, it looks smaller than when it is on the ground.

#### What I Think Will Happen—My Hypothesis:

I think that moving objects away from the observer will make them appear smaller.

<sup>1</sup>These MEGOSE objectives directly correspond to the following science standards and content benchmarks from the Michigan Science Curriculum Framework: Elementary School I1.2, I1.4, I1.5, II 1.1, V 4.1.

**Materials That We Will Use:** (for each group of at least 4 students)

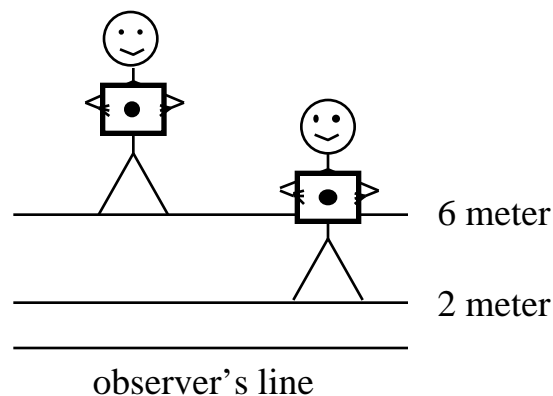
1 sheet of white paper with 2 cm diameter black circle, labeled “circle 1”  
1 sheet of white paper with 2 cm diameter black circle, labeled “circle 2”  
1 sheet of white paper with 3 cm diameter black circle, labeled “circle 3”  
metric ruler  
masking tape

**Procedure for Students to Follow:** (The following procedure is identical to the procedure listed in the Size and Distance Investigation Journal.)

**Procedure:**

**Part 1**

1. Select an observer and have that student stand on the observer’s line.
2. Have one member of the group hold circle 1 (a 2 cm circle) on the 2 meter line of the distance layout.
3. Have another member of the group hold circle 2 (a 2 cm circle) on the 6 meter line of the distance layout. The observer now compares how the sizes of circle 1 and circle 2 look and reports orally to the group. Record what the observer said for circle 1 and circle 2 on the line for that observer in Table 1.
4. Repeat steps 1, 2 and 3 until all students in the group have had a chance to be the observer for Part 1.





**Part 2**

5. Select a student as an observer and have this student stand on the observer's line. Have one student in the group hold circle 1 while standing at the 2 meter line. Have another member of the group hold circle 3 (a 3 cm circle) while standing at the 6 meter line. The observer compares the sizes of circles 1 and 3 and reports orally to the group. Record this information in Table 2 on the line corresponding to this observer's number.
6. Have the student holding circle 3 move forward or backward until circle 1 and circle 3 appear to be the same size to the observer. Record in Table 2 the distance that the person holding circle 3 is from the observer's line when the observer states that circle 1 and circle 3 appear to be the same size.
7. Repeat steps 5 and 6 until all students in the group have had a chance to be the observer for Part 2.

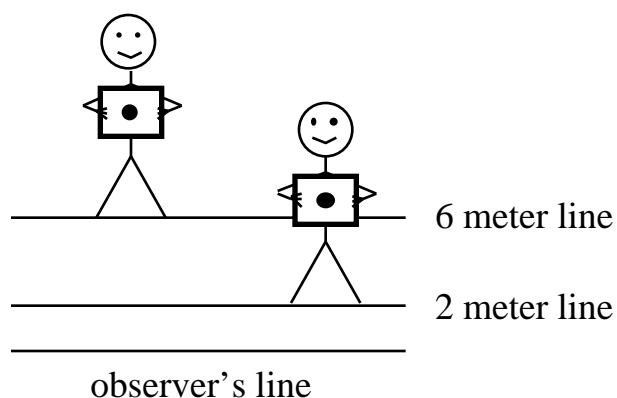


Table 1

Comparison of Circles 1 and 2		
Observer #	Circle 1 at 2 meters distance	Circle 2 at 6 meters distance
1	looked larger	looked smaller
2		
3		
4		

Comparison of Circles 1 and 3			
Observer Number	Circle 1 at 2 meters distance	Circle 3 at 6 meters distance	Distance from observer's line at which both circles appear to be the same size to the observer
1	looked smaller	looked larger	10.5 m
2			
3			
4			

**Sample Conclusion (include reasons for your conclusion):**

Objects look smaller when they are farther away. As the student with circle 3 moved backward, circle 3 appeared to become smaller.

**Sample Some Possible Errors — (Error Analysis):**

Measurement error marking distance  
Individual differences